

# Literacy-Based Normative Data for Elderly Adults on Linguistic Profile Test in Kannada and Malayalam

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## Abstract

**Objectives:** Literacy is an important variable that can influence the performance of persons with aphasia on language tasks. This study aimed to generate the literacy-based normative data in two Indian languages (Kannada and Malayalam) for a linguistic tool originally designed for adults with acquired language impairment following brain damage—the Linguistic Profile Test (LPT). **Methods:** The Kannada and Malayalam versions of LPT were administered on 134 and 127 normal speakers of these languages, respectively. The participants were divided into three literacy groups (nonliterate, semiliterate, and literate). The scores on each section of the test as well as the overall scores were determined, as per the instructions provided in the test material. **Results:** The influence of literacy was apparent in semantic and syntax sections of the LPT. Participants from nonliterate group performed notably poorly on these two tasks compared to other two groups. Literacy, however, did not show an effect on the “phonology” section of LPT. **Conclusion:** The literacy-based norms of LPT developed here could improve the sensitivity of clinical evaluation by reducing the “false positives,” especially while evaluating the language skills of nonliterate persons with brain damage.

**Keywords:** Aphasia, Kannada, language, literacy, Malayalam

**Guest editor’s notes:** Literacy rates in India are improving, yet a sizable minority remains pre-literate or barely literate. Test stimuli in various batteries in clinical neuropsychology and aphasiology may be too difficult for these subgroups leading to false positive conclusions. The authors, while desirous of resurrecting Linguistic Profile Test (LPT), (which was indigenously developed contemporary to legendary Western Aphasia Battery), aimed to establish literacy-based norms for the LPT in Kannada and Malayalam. The pre-literate performed notably poorly on semantic and syntactic, but not so for phonological tasks. The authors hope that the literacy-based norms of LPT developed by them could improve the specificity of clinical evaluation.

## INTRODUCTION

The link between language and literacy has been widely established by several streams of inquiries. For instance, from the developmental perspectives, children who experience language delay in their early childhood tend to exhibit later academic deficits.<sup>[1,2]</sup> Similarly, nonliterate adults perform poorly on tests of language functions.<sup>[3,4]</sup> These observations highlight the need to consider the literacy level of the persons undergoing the linguistic assessment to arrive at an accurate diagnosis.

Adults often undergo the language assessment following injury or certain degenerative changes in their brain. The cerebrovascular accident (CVA or stroke) and other insults to the brain can often impair the use of language—a condition known as aphasia—in the affected persons. Like many other common consequences of brain damage such as hemiparesis and sensory-perceptual deficits, aphasia is a potential detriment to the quality of life in this population.<sup>[5-7]</sup> A comprehensive rehabilitation program for people with aphasia shall, therefore, include a detailed assessment of impaired language functions.

In English, several tools are available to assess the language functions in adults with language impairment acquired at a later

age, specifically for aphasia. These tools have been adapted to several other languages around the world. The original versions of the aphasia tests are often developed based on certain theoretical constructs on this disorder. For instance, the Western Aphasia Battery (WAB)<sup>[8]</sup> is a widely used assessment battery that has been designed on the neuroanatomical localization of various aphasias. Another widely used test—Psycholinguistic Assessment of Language Processing in Aphasia (PALPA)<sup>[9]</sup>—has based its design architecture on the psycholinguistic

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**Submitted:** 18-Jun-2020 **Revised:** 28-Jul-2020 **Accepted:** 12-Aug-2020

**Published:** 25-Sep-2020

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**DOI:** 10.4103/aian.AIAN\_636\_20

constructs in aphasia. Thus, it becomes apparent that the tools that are available have been designed on various theoretical grounds on the language impairment in aphasia.

The tools used for the assessment of language in persons with aphasia exert considerable influence on the rehabilitation program. For instance, the WAB is a meticulous tool that delineates the neuroanatomical localization of various aphasia types. While this battery was a value addition to clinical practice in the 1980s when the neuroimaging tools were largely unavailable to determine the neural substrates in persons with aphasia, the proliferation of imaging tools in the subsequent decades greatly undermined the primary purpose of the tool. Nevertheless, several investigations have provided structural evidence for the lack of clinicoanatomical correlation in persons with aphasia.<sup>[10]</sup> This is largely evident in the case of aphasias following subcortical (e.g., basal ganglia) lesions.<sup>[11]</sup> Thus, with the pervasive availability of structural neuroimaging techniques in the clinical settings, the primary objective of WAB has become nevertheless feeble. This battery is the mainstay of assessment of aphasia in several languages in the world.

In most non-English languages, the adaptation of widely used assessment tools for aphasia from English has largely filled the lacunae. However, the pervasive use of such tools largely limits assessments based on alternative theoretical views on aphasia. For instance, the original version of WAB has been adapted to various Indian languages, and these adapted versions remain as the test of choice in most languages of the subcontinent. The overarching use of WAB has largely constrained the views on aphasia to the neuroanatomic perspectives. The assessment of linguistic components (e.g., syntax, semantics, phonology, etc.) in this population has seldom been carried out in Indian clinics. It is surprising that around the time Kertesz<sup>[8]</sup> developed WAB in English, a test for the assessment of linguistic components in persons with brain damage was developed in Kannada by Karanth (the Linguistic Profile Test).<sup>[1]</sup> However, this test largely remained far from routine clinical use in this population and later became an indigenous test of choice in the assessment of language impairments in children.

Karanth<sup>[12]</sup> emphasized that most translated versions of aphasia tests in Indian languages aid primarily in the diagnosis and classification of aphasias. Though it is pertinent to diagnose and classify the aphasic syndromes, these assessment tools seldom provide any direction on planning the intervention and monitoring the progress following therapy.<sup>[12]</sup> It is, therefore, essential to use language tests that aid in planning the intervention programs. Further, the use of assessment tools that provide insights on aphasia from perspectives other than the neuroanatomic views is the need of the hour in the Indian context. The Linguistic Profile Test (LPT)<sup>[1]</sup> is a potential tool that is designed to assess the linguistic deficits in persons with acquired language disorders. Below, a brief description of this test is presented.

### The linguistic profile test

The LPT consists of three major sections: phonology, syntax, and semantics. The section “phonology” comprises

phonemic discrimination and production tasks. For phonemic discrimination, pictures of minimal pairs are used along with phonemic and semantic foils. The phonemic expression is tested through either naming (pictures or objects) or reading of printed words/text as well as through running speech samples. The “syntax” section primarily assesses the patients’ ability to judge various syntactic structures. Similarly, the “semantic” section uses several tasks such as naming, lexical categories, polar questions, synonyms, antonyms, paradigmatic and syntagmatic relations, similarity and contiguity, and identification of semantically anomalous sentences.

The LPT, originally developed in Kannada,<sup>[1]</sup> has been adapted to several Indian languages. This test has also been used for planning intervention programs for persons with aphasia as well as for the evaluation of progress in them. The normative data for LPT is available for the pediatric population in several Indian languages (e.g., Kannada: In children from 6–16 years of age).<sup>[13]</sup>

Considering that the LPT has primarily been developed for persons with aphasia, the normative data for adults in most languages are not readily available for clinical and research purposes. Further, in agreement with Karanth,<sup>[12]</sup> while most trans-adapted test materials for persons with aphasia aid only in the diagnosis and classification of aphasia syndromes, the LPT provides a viable indigenous alternative to assess the linguistic deficits in persons with aphasia. However, to augment its use in the clinical and research fronts, readily available norms are essential, which in turn, motivated this study.

As mentioned in the preceding section, the participants’ performance may be influenced by several factors. For instance, the age and literacy level of the persons with brain injury are known to influence the performance on language tests. Lecours *et al.*<sup>[3]</sup> emphasized the importance of the literacy level of persons with brain damage on their performance on linguistic tests. Recently, Krishnan and colleagues<sup>[4]</sup> provided empirical evidence for the role of literacy in various word retrieval tasks. These authors found that the illiterate participants performed significantly poorer to their literate counterparts on various word retrieval tasks. These observations have overwhelming significance in the Indian context as a considerable proportion of the population in the country remains illiterate. According to the recent census records,<sup>[14]</sup> about 273 million people  $\geq 7$  years of age remain as nonliterate in India. Assessment of language functions in illiterate persons with brain injury, thus, necessitates the development of specific normative data for this population. In this context, the present study was undertaken to resurrect the use of LPT in the assessment of Kannada or Malayalam-speaking adults with language impairment. Toward this ambitious goal, this study aimed to establish literacy-based norms for the LPT in Kannada and Malayalam. These are two of the many Indian languages that belong to the alphasyllabic orthography. For a detailed account of the linguistic structure of Indian languages, the readers are directed to Karanth.<sup>[15]</sup>

## METHODS

The permission to conduct this study was approved by the institutional research committee of the host institution. All participants signed the informed consent to participate in the current study.

### Participants

We recruited 261 neurologically healthy elderly participants in this study. They included 134 native Kannada speakers and 127 native Malayalam speakers. The participants in the Kannada group were recruited from three geographical areas (i.e., South Canara, Mysore, and Bangalore) in Karnataka. Those in the Malayalam group were selected from southern, central, and northern regions of the state of Kerala. Karnataka and Kerala are two southern states of India, where the primary spoken language is Kannada and Malayalam, respectively. None of the participants had any physical or sensory deficits that warranted their exclusion from the current study.

Within each language, we operationally categorized the participants to three subgroups based on their literacy levels (nonliterate—no formal education to academic training up to 2<sup>nd</sup> grade; semiliterates—academic training from 3<sup>rd</sup> to 8<sup>th</sup> grade; and literates—academic training up to 9<sup>th</sup> grade and beyond). Table 1 provides the age and literacy details of the three subgroups of participants in both languages.

### Material and procedure

We administered the LPT on each participant individually as per the instructions available with the test in an ambient, well-lit room environment. The second author administered the test on Malayalam-speaking participants and the last author administered on Kannada-speaking participants. Before the administration, they briefed each participant about the purpose of this study as well as the option for a (short) break during the administration. All manual (or pointing) tasks were recorded online by the examiner (in each language) in a pencil-paper format. The verbal responses were audio-recorded with a portable recorder (Sony P-370) for offline analysis and scoring. The average administration time across the participants in all three groups was 35 min. While most participants completed the entire test in a single sitting, approximately 10% needed a break in administration and expressed their willingness to continue on the following day. Each correct and incorrect response received a score of one and zero, respectively. We used Statistical Package for Social Science (SPSS version 15) for the analysis of the data.

## RESULTS

The descriptive statistics of the scores on phonology, syntax, semantics, as well as the overall scores across the three participant subgroups in each language, is presented in Table 2.

Among the three sections of LPT, the scores of phonology dispersed less across the participant groups. However, the effect of literacy on syntax and semantics was apparent as the semiliterates and literates obtained higher scores. In addition to the descriptive data, the percentile distribution of scores (an index of the percentage of participants who scored equal or less than the corresponding score) on phonology, syntax, and semantics, as well as the overall scores on LPT from all three participant groups in Kannada and Malayalam, is made available online for clinical and research purposes (see supplementary online Material).

Though we did not intend to perform a literacy-based comparison of the groups in the current study, to substantiate the intention of the current study, we carried out such an analysis. That is, a significant difference among the participant group on various subsections of LPT would prove the need for the literacy-based normative data. We performed one-way analysis of variance (ANOVA) on each of the sections as well as on the overall scores of LPT separately in Kannada and Malayalam. This analysis revealed statistically significant difference between the groups across the LPT sections in Kannada [Phonology:  $F(2,131) = 13.09, P < 0.001$ ; Syntax:  $F(2,131) = 25.81, P < 0.001$ ; Semantics:  $F(2,131) = 12.85, P < 0.001$ ; and Overall scores: ( $F(2,131) = 29.05, P < 0.001$ )] as well as in Malayalam [Phonology:  $F(2,124) = 13.13, P < 0.001$ ; Syntax:  $F(2,124) = 274.92, P < 0.001$ ; Semantics:  $F(2,124) = 79.85, P < 0.001$ ; and Overall Scores:  $F(2,124) = 204.17, P < 0.001$ ]. Planned comparisons revealed that the three participant groups' mean scores differed significantly from each other in most sections of the LPT except three conditions [see Table 3].

## DISCUSSION

Assessment of linguistic skills is an integral component of the comprehensive evaluation and management of persons with brain injury/damage. However, unlike other skills (e.g., motor or sensory), the performance on linguistic tasks is influenced by several demographic and sociocultural factors. The literacy level of the participants is such a potential factor that can influence the performance on language tests.<sup>[3,4]</sup> Further, the assessment of linguistic components in persons

**Table 1: Descriptive statistics of the age and literacy levels of the participants**

Participant subgroups	N	Kannada				Malayalam				
		Age (years)		Education (years)		Age (years)		Education (years)		
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Nonliterate	38	68.34	12.06	0.91	0.46	41	65.87	11.67	0.26	0.06
Semiliterate	39	64.52	8.3	5.63	1.23	39	62.56	8.0	5.23	1.93
Literate	57	68.78	11.38	12.32	3.05	47	63.91	8.64	14.81	3.76

**Table 2: Descriptive statistics of the LPT scores across the participant groups and languages**

		Kannada			Malayalam		
		Mean	SD	Range	Mean	SD	Range
Phonology	Nonliterate	98.14	1.48	88-100	99.04	1.22	96-100
	Semiliterate	100	0	-	99.53	0.94	97-100
	Literate	99.93	0.42	97-100	100	0	-
Semantics	Nonliterate	82.78	6.78	59-93	80.22	7.84	56-88
	Semiliterate	87.26	6.37	70-97	84.18	5.85	72-96
	Literate	91.73	4.21	79-97	95.81	4.08	82-100
Syntax	Nonliterate	70.08	9.87	37-86	64.00	3.07	56-69
	Semiliterate	76	12.65	15-90	67.81	7.0	52.5-92.5
	Literate	84.54	6.87	70-97	94.37	8.41	63.5-100
Overall	Nonliterate	251	17.67	188-270	244.76	10.42	215.5-257
	Semiliterate	263.26	16.71	194-284	250.37	12.28	231-288.5
	Literate	276.2	9.24	252-291.5	290.51	12.13	245.5-300

**Table 3: Pair-wise comparison of the participant groups on the three sections of LPT**

Groups		Sig	
		Kannada	Malayalam
Phonology	NL-SL	<0.001	0.039
	NL-LT	<0.001	<0.001
	SL-LT	1.00 <sup>NS</sup>	0.047
Semantics	NL-SL	0.237 <sup>NS</sup>	0.012
	NL-LT	<0.001	<0.001
	SL-LT	0.007	<0.001
Syntax	NL-SL	0.025	0.035
	NL-LT	<0.001	<0.001
	SL-LT	<0.001	<0.001
Overall	NL-SL	0.006	0.097 <sup>NS</sup>
	NL-LT	<0.001	<0.001
	SL-LT	<0.001	<0.001

NL-nonliterate; SL-semiliterate; LT-literate; NS-not significant

with language impairment (PwLI) is seldom carried out in Indian languages owing to the overwhelming use of the adapted versions of the WAB.<sup>[8]</sup> In this context, we established literacy-based normative data for the older adults using the LPT in Kannada<sup>[1]</sup> and Malayalam<sup>[16]</sup> with an intention to promote the linguistically oriented assessment of PwLI in these languages.

Among the three sections of the LPT, the scores of the three participants group showed the least dispersion in phonology section [see Table 2] in Kannada and Malayalam. In this section, the literate and semiliterate groups obtained near-total scores compared to the nonliterate group. Unlike in phonology, the gradation of performance was apparent in semantics and syntax across the participant groups in both languages [see Table 2]. That is, the nonliterate obtained lowest scores, and the literates fetched highest scores with the semiliterates falling midway. This gradation in the test performance across the participant subgroups was substantiated by the results of ANOVA (see Results). Based on this finding, we recommend

the use of appropriate literacy-based norms of LPT while using it for clinical purposes to improve the ecological validity of the assessment outcome.

The percentile scores provided in this study can be readily used to evaluate the performance of participants on LPT in Kannada and Malayalam. While the LPT can aid the clinicians to design linguistically based intervention programs for elderly PwLI, the normative data (specifically, the percentile scores) established here is more appropriate to monitor the changes associated with the intervention.

For the assessment of linguistic deficits in PwLI, we **do not** advocate the replacement of WAB with LPT as these two tools belong to distinct theoretical constructs. For instance, as mentioned earlier, the WAB provides potential insights into the neuroanatomical substrates of aphasia (e.g., Broca's aphasia possibly arising from damage to the Broca's area) that aid majorly in the diagnostic classification of aphasia. The LPT, on the other hand, is purely a linguistically based tool that assesses the linguistic competence of the PwLI. That is, the LPT is latent on the neuroanatomical substrates of aphasia, and its strength lies in the identification of the deficient linguistic components in PwLI. In this context, it is worthwhile admitting that the normative data in the current form may not be used to diagnose language impairment, as it requires additional standardization procedures in PwLI. A more constructive approach, then, would be to use the WAB and LPT in a complementary manner as the former would aid in the diagnostic classification and the latter would help in the linguistic profiling persons with aphasia. Further, the currently established norms (percentile scores) may be used to monitor the changes associated with intervention or spontaneous recovery.

It may be noted that the utility of the normative data established in this study is not limited to persons with aphasia alone. Rather, it may also be used in any PwLI including aphasia, dementia, or in those with traumatic brain injury. However, we strongly recommend the use of specific assessment tools for the intended clinical population (e.g., Dementia Rating Scale

for persons with dementia) along with the LPT so that specific linguistic deficits may be uncovered, which in turn, could lead to the effective management of such deficits.

### Limitations of the study

Despite the potential of the current normative data, we acknowledge a few limitations of this study. First, the intratester and intertester reliabilities were not assessed. Further, we did not administer the test on persons with aphasia. Future studies may, therefore, address these limitations to make this test as well as the current normative data more clinically appealing.

### CONCLUSION

To conclude, this study provides the normative data on a linguistically based assessment tool (LPT) in Kannada and Malayalam for elderly population. Although this tool does not replace the existing tools (e.g., WAB) for the assessment of linguistic deficits in these languages, its combinatorial use with such tools is expected to improve the comprehensiveness of the assessment process. Finally, the current normative data may aid in the planning of focused linguistically oriented intervention programs in elderly PwLI in Kannada and Malayalam.

### Declaration of patient consent

The authors certify that they have obtained all appropriate participant consent forms. In the form, the participants have given their consent for their images and other clinical information to be reported in the journal. The participants understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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